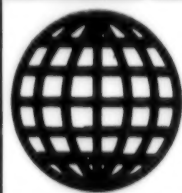


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4 October 1993



**FOREIGN
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ADVANCED MATERIALS

Fullerene Catalyst Research in FRG, Switzerland

93WS0660A Frankfurt/Main FRANKFURTER
ALLGEMEINE in German 4 Aug 93 p N2

[Article by Karin Assmann: "Catalyst Research—Alchemy and Science. Fullerenes As a Support for Metal Clusters/Synthesis on the Computer"]

[Text] A large number of chemical processes are accelerated or even just made possible by catalysts. The range extends from the treatment of petroleum, to the manufacturer of pharmaceutical biocatalysts, to the reduction of polluting emissions from power plants and automobiles. Moreover, catalysts not only affect the speed of a reaction, but can selectively influence the formation of the desired product, for they suppress secondary reactions. Less feedstock is required because of this, and energy consumption is reduced. Consequently, catalysis is gaining in importance more and more also for ecological reasons.

In spite of these merits, thus far only a little is known about the precise way these useful compounds work. The search for selective catalysts often assumes the form of laboriously trying out various systems—half science and half intuition. It would be chemically more elegant and less expensive to develop such materials specifically for individual reactions. In recent years scientists have been working intensively on the action of catalysts in order to create the theoretical prerequisites for this. New research results on heterogeneous systems were presented recently at a conference in Berlin. While homogeneous catalysis requires a completely soluble catalyst, in heterogeneous catalysis the chemical reaction takes place on the surface of solids. As a rule they consist of finely divided particles—for the most part metals or metallic compounds—that are fixed on a solid support. The size of the particles plays a decisive role here: The smaller and more homogeneous they are, the more strongly they speed up the reaction. For this reason, aggregations of a few metal atoms, so-called clusters, are particularly promising. However, the high activity of these clusters is at the same time an advantage and disadvantage. They not only catalyze the chemical reaction, but according to the support material have a tendency at high temperatures to settle together on large more stable particles. Their effectiveness drops quickly because of this.

Robert Schlögl's team at Frankfurt University has now for the first time produced from each of four metal atoms clusters unaffected by changes in temperature. Fullerenes serve as the support material. Iron, palladium and ruthenium are used. Schlögl was able to give spectroscopic proof of the fact that it is a question of genuine intercalation compounds here—so-called intercalations. Moreover, the clusters are not bound loosely to the surface of the crystal but occupy a portion of the free lattice positions in the crystal. This kind of arrangement holds the metal atoms firmly in place, so that they cannot bond themselves to larger particles at high temperatures.

The first studies show that these systems are stable at temperatures of approximately 200°C, in contrast to similar compounds with graphite as the support material. Furthermore, the slow-to-react fullerenes offer the advantage that they themselves do not influence the reaction. For this

reason the kinetics and dynamics of catalytic processes at metal clusters can be studied by means of such compounds. But great interest in these compounds prevails also from the engineering viewpoint. The hope is that, because of their high activity, they will make chemical reactions possible that thus far have not been approachable catalytically.

The researcher's biggest dream is to design catalysts on the drawing board, so to speak. However this presumes that they know and can describe mathematically the course of a catalyzed reaction—a thus far insurmountable hurdle. Alfons Baiker's team at the Federal Technical College in Zurich has now for the first time simulated on the computer the decisive interaction between the starting compound and catalyst for enantio-selective synthesis. Enantiomorphs are molecules that differ only in their spatial arrangement at a so-called chiral atom. They are mirror images of one another, like one's hands, and cannot be superimposed. Such compounds play a large role in the pharmaceuticals industry, because they have various biological properties: Whereas one molecule exhibits a therapeutic effect, for example, its mirror image in the same concentration can be toxic.

While nature seems to produce pure enantiomorphs enzymatically without effort, in most cases heterogeneously catalyzed synthesis in the laboratory results in a compound that has to be laboriously decomposed. The synthesis that Baiker has investigated is an exception. The starting compound contains a carbon- and oxygen-atom double bond that is transformed into a single bond by reaction with hydrogen. The carbon atom is chiral in the new compound, and both enantiomorphs form equal components. Moreover, the decomposition of the hydrogen molecule is catalyzed by platinum and aluminum oxide. However, the reaction proceeds selectively with the addition of a chiral natural substance—a cinchona alkaloid; an enantiomorph is preferentially formed. Moreover, the alkaloid for a short time combines with the substrate to form a complex compound, shields one side of the compound against the hydrogen, and thus defines the future spatial arrangement of the new molecule. The structure of this complex compound is decisive for the course of selective synthesis. If one were to manage to figure out this structure for whatever reaction one chooses, enantio-selective catalysts could be custom-made, so to speak.

The people in Zurich have figured out the structure of this intermediate product by means of a mathematical procedure, the quantum chemistry technique. The alkaloid performs two tasks here. The aromatic component of the molecule is bound parallel to the surface of the catalyst and thus brings about good contact between the substrate and platinum. The aliphatic component activates the double bond for the reaction with hydrogen. Calculations showed that the nitrogen atom of the aliphatic component assumes a central role at this step. With an acid present, a proton is added to the free pair of electrons of the nitrogen. This proton forms a hydrogen bond to the oxygen atom and thus weakens the double bond. This step is decisive for the subsequent oxidation. However, the scientists have thus far not been able to clarify whether the complex compound is formed in the solution or first on the surface of the catalyst.

The growing scarcity of raw materials has resulted in recent years, both for economic and ecological reasons, in growing

interest in catalysts that act selectively—a task to which many researchers have devoted themselves with considerable success. Today science is playing in the development of catalysts a substantially larger role than only about 10 years ago. But it is uncertain whether the pre-intended catalyst will ever be produced. Thus far only the theoreticians believe in this.

Netherlands: Consortium To Develop Composites for Naval Shipbuilding

BR1709142993 Rijswijk POLYTECHNISCH WEEKBLAD in Dutch 6 Aug 93 p 3

[Unattributed article: "Netherlands in European Composite Research"]

[Text] A consortium of five Netherlands companies and research institutes has won a prestigious order to develop composites for shipbuilding. According to TNO [Netherlands Organization for Applied Scientific Research], which is also participating, the project will give the Netherlands a good chance to become a world-class player in the composite materials field.

The five Netherlands companies will take part in an international research program coordinated by a Norwegian company. The Netherlands participants will be led by the Center for Mechanization and Construction [CMC] of TNO's Building Division. The Netherlands' contribution will involve a five-year research project which eventually is to allow the large-scale use of composites in navy ships. It involves experiments, studies, and computer simulations. Particularly important areas include research into material strength, constructive behavior under typical loads for navy ships, repair methods, fire-resistance, and electromagnetic protection. It is possible that the knowledge acquired can also be applied in civil shipping and construction. The other Netherlands participants, in addition to CMC-TNO, are DSM Resins, Koninklijke Schelde Groep [Royal Scheldt Group], Polymarin, Hollandse Signaal Apparaten, and two other divisions of TNO: the Plastics and Rubber Institute and the Fire Safety Center.

Germany: Karlsruhe University Develops Highly Resistant Fibers

MI3009154093 Bonn WISSENSCHAFT WIRTSCHAFT POLITIK in German 25 Aug 93 p 6

[Text] The Chemical Engineering Institute of Karlsruhe University has succeeded in producing a monocrystalline silicon nitride fiber. It is the strongest fiber in the world with a tensile strength of 30 to 50 Giga Pascals (GPa) and a modulus of elasticity of 550 to 750 GPa.

This is two to three times stronger than so-called whiskers, the strongest materials known so far. But its geometry makes it far superior to whiskers. If it proves possible to produce the fiber industrially, it can be used to make ceramic composite materials for very high temperature gas turbines, making possible a much more efficient use of the fossil fuels coal, oil and natural gas, and reducing pollutant emissions (primarily CO₂).

To make the fiber, a method of synthesizing volatile silicon-hydrogen composites was first developed. At approximately 1,300° C specially pretreated silicon powder reacts with

molecular hydrogen to form the desired thin silicon-hydrogen composites. To form the silicon nitride fiber, nitrogen is also required. Ammonia was used as the nitrogen source, being like silicon powder and hydrogen an inexpensive industrial product.

'Baking Temperature' 1,300 Degrees

At this high temperature the silicon nitride fibers are formed on iron particles a few thousandths of a millimeter in diameter that serve as catalysts. The volatile silicon-hydrogen composites and ammonia decompose on the iron particles, which dissolve silicon and nitrogen, simultaneously exuding the monocrystalline silicon nitride fibers. Growing the several centimeters long fibers currently takes several hours, but the researchers headed by Dr. Thorsten Pieschnick say the process has considerable development potential for fiber-reinforced ceramic materials.

Germany: Max Planck Institute Develops Corrosion Detection Process

MI2109150793 Munich SUEDEUTSCHE ZEITUNG in German 2 Sep 93 p 33

[Text] Materials experts at the Max Planck Institute of Iron Research in Duesseldorf have developed a method for detecting corrosion beneath a protective coat of paint. Martin Stratmann and Heinz Streckel use a high-precision stepping motor to position a needle at a distance of down to 0.01 millimeter from the surface under inspection. Like a sewing machine, the fine point then pounds up and down 2,000 times per second, without touching the paint.

Together, the metal under the paint and the needle act as a condenser. The varying distance between the electrode and the metal plate generates minute currents, which are converted into potential differences. The voltage varies by a few thousandths of a volt according to the metal and the corrosion. Sound expanses have a positive potential, whereas that of corroded points is negative. But the scientists can use their method not only to detect incipient, microscopic damage but also to establish the speed of propagation and the extent to which it depends on the alloy and the various coatings. This new method has particular potential for the automobile, paint, and sheet metal industries.

AEROSPACE

Ariane Makes Double Launch

93WS0661C Paris AFP SCIENCES in French 29 Jul 93 pp 5, 6

[Article: "Hispasat-1B and Insat 2B Launched"]

[Text] Kourou—On the night of 22 July, Europe's 58th Ariane successfully lofted two telecommunications satellites into orbit: Spain's Hispasat-1B and India's Insat-2B.

The rocket was launched at 22:58:55 hours UT [universal time], 11 minutes after the scheduled launch time (22:47 UT) but comfortably inside the 65-minute launch window. The liquid oxygen and hydrogen tanks of the third-stage Ariane-44L had to be completely filled to lift the 4,615 kg payload—the heaviest ever—from its launch pad in [French] Guiana.

In the cloudless starry night with only a thin crescent moon, the rocket could be tracked visually far up into the sky. This launch, the third this year for Arianespace, benefited from the perfect meteorological conditions characteristic of Guiana's dry season. It was the 22d consecutive successful launch for the European rocket.

Mrs. Elena Salgado, president of Hispasat, was clearly pleased. She noted that it was 10 years ago when the first Spanish satellite was launched from Kourou, with Prince Felipe in attendance. "Hispasat satellites are indispensable to our country's modernization and to maintaining communications with Spanish forces deployed under the UN flag, particularly in Bosnia," she said. "Ariane truly deserves its reputation as the world's best launcher." She thanked Matra Marconi Space and the Spanish manufacturers, "who must also be congratulated for having given us these perfect satellites."

"It's a great moment for all of us, and another great success tonight for Ariane," said Professor Udi Ramachandra Rao, president of ISRO (Indian Institute of Space Research). "I would like to thank you on behalf of the government, my agency, and the Indian people, in whose everyday lives satellites such as Insat-2B play a constantly growing role, in areas such as telecommunications, meteorology, and rescue operations."

In the days ahead, the two satellites will be moved from the excellent transfer orbits in which they were initially placed into geostationary orbits where they are supposed to remain in operation for about a decade.

Mr. Charles Bigot could not hide his great satisfaction at the success of this 58th Ariane, yet another demonstration of the practicality of Arianespace's approach to space. With this 22d consecutive success, the European rocket confirms its position as the West's number one satellite launcher, with a commanding lead over its most direct competitor, the U.S. Atlas.

Hispasat-1B, Spain's second telecommunications satellite, and Insat-2B are the 49th and 50th satellites respectively to be launched into orbit by the Ariane-4, the 30th in the series and the 13th configured in the version designed to deliver maximum power.

The Ariane can claim 96 percent reliability, an important technical-commercial selling point in the global competition for contracts, especially now that the Russians and Chinese are becoming more aggressive rivals.

With this double launch out of the way, Arianespace has 39 outstanding orders for satellites to be orbited between now and 1996, orders worth 17.7 billion French francs [Fr]. If a third Hispasat were to be launched, there seems little doubt it would be on Ariane. For his part Mr. Rao readily acknowledged India also planned to use Ariane for its Insat-2C, 2D, and 2E, the three other ISRO satellites now under construction.

Between now and the end of the year, Arianespace hopes to orbit six more satellites on four rockets. The next one, which is to carry France's SPOT-3 and seven microsattellites, is scheduled for launch on 31 August. It will be followed by the first Intelsat-VII-F1 in early October, then (in double launches) Mexico's Solidaridad and Europe's MOP-3 in

November, and finally the U.S.'s Direct-TV-1 and Thailand's Thaicom-1 in December.

Constant efforts to improve Arianespace and CNES [National Center for Space Studies] operational procedures at the Guiana Space Center have reduced the minimum time between launches to 28 days, which means that "if it were necessary, we could do 10 or 11 launches per year," said Mr. Bigot.

Doing a booming business at a time when the European aerospace industry as a whole is reeling from recession, the launcher is going to be enhanced even further. Next year, for example, the payload will be increased by 100 kg, and a more efficient procedure will be used to fill the third-stage fuel tanks for Ariane-44L launchings. In fact, it was this new procedure, first attempted on the 22 July launch, that was responsible for the slight launch delay.

The hitch was caused by the fact that the temperature at Kourou on the night of the launch was higher than predicted and different from temperature conditions during earlier tests. As a result, sensors signaled completion of successive fueling phases prematurely, and the computer therefore shut down the new continuous fueling procedure—which eliminates the synchronized 6-minute sequence—forcing the process to be restarted from the beginning.

Beyond these recent enhancements, little remains to be done but continue to improve the reliability and quality of the services provided, an objective already largely integrated into the strategy of Arianespace and its work teams.

The transfer orbit into which Ariane "parked" its passengers is excellent: The perigee is 200.3 km, compared to the 199.7 km target; the apogee is 35.957 km, compared to the target apogee of 35.991, and the orbital inclination is 6.96°, compared to the target inclination of 6.99°. The owners of the two satellites are naturally very pleased.

Germany: DARA, DASA, Jena Optronik Develop Precision Solar Sensor

*MI2109132893 Bonn TECHNOLOGIE-NACHRICHTEN
MANAGEMENT-INFORMATIONEN in German
30 Jul 93 p 14*

[Text] In a joint project between Deutsche Aerospace (DASA) and Jena Optronik, the German Space Agency (DARA) is supporting the development of a high-precision solar sensor (PSS) with funding from the BMFT [Federal Ministry of Research and Technology]. Research expenditure totals approximately 6 million German marks [DM]. Jena Optronik's development costs of roughly DM3 million are being financed to the tune of about DM1.6 million with German Government subsidies.

The PSS solar sensor is an integral and key component of the new positional, orbit control, and data system known as ICDS (integrated control and data system), which will be used for the first time and tested under the ESA [European Space Agency] mission ARTEMIS in order to experiment with new technologies for future communications and earth observation satellites.

In 1996, the ARTEMIS European technology satellite will be put into geostationary orbit using an Ariane launcher.

The satellite bus with the ICDS as subsystem is being designed and built by the European industrial consortium including DASA (Germany), Alenia (Italy), Alcatel (France), and Aerospatiale (France). As an intelligent control system, the ICDS to be developed by DASA combines the control subsystem for controlling the satellite's position and flight path, the data processing subsystem, and a ground-programmable onboard computer. This will make positional and orbit control as well as monitoring of individual subsystems of the entire satellite possible independently in the future, thereby increasing the satellite's economy by reducing ground-based operating costs.

The PSS will reduce positional and orbit control subsystem expenditure, since it weighs only 9 kg with a power consumption of only 8.6 W.

The project aims to design, construct, and test this high-precision sensor in preparation for its deployment under the ESA ARTEMIS project. In addition to purely development tasks, however, the funding also covers investment for constructing and commissioning laboratory equipment to test PSS qualification and flight models.

Qualification, construction, and first use of a flight model on the ESA ARTEMIS technology test satellite will follow the DARA-funded development phase, with Germany making a 12-percent contribution to the ECU530 million costs.

Design of ESA's Global Ozone Monitoring Equipment Tested

BR2209081193 Noordwijk *EARTH OBSERVATION QUARTERLY* in English Jul 93 p 8 (tentative)

[Unattributed article: "GOME Critical Design Review"]

[Text] A major milestone for the Global Ozone Monitoring Experiment (GOME) was reached when its Critical Design Review (CDR) was successfully held on 7-11 June in Florence (Italy), the home town of the instrument's prime contractor Officine Galileo. GOME is a four-channel nadir sounding spectrometer covering the wavelength range of 240-790 nm with a resolution of 0.2-0.4 nm. It will be the only entirely new instrument to fly on satellite ERS-2 [European Remote Sensing Satellite], scheduled for launch in December, 1994, and the first European spaceborne instrument to measure ozone and related trace gases.

The Review Board consisted of the ESA project team and specialists from ESTEC [European Space Research and Technology Center], ESOC [European Space Operations Center], ESRIN [European Space Research Institute], the satellite prime contractor Dornier, the contractors for instrument calibration and data processing, and the scientific user team. It scrutinized the results obtained with the prototype instrument, in particular:

- The vibration test at qualification acceleration levels, performed at Dornier, proved the soundness of the structural design;
- The thermal vacuum test at qualification temperature levels, performed in the Galileo thermal vacuum chamber, did not only prove proper functioning at all temperatures, but also revealed that an excellent spectral stability can be expected for the in-orbit performance;

—Functional and performance test, proving the proper execution of all functions and instrument modes.

Some deficiencies were identified by the review board. These included the lack of an electromagnetic compatibility (EMC) test, missing the CDR at unit level for some units, and several critical component procurements which might have impact on schedule or performances or both. In addition, performance improvements are required in the areas of straylight, electronic noise, and scanner performances. Actions and investigations into all these areas have been initiated immediately after the review.

The Review Team appreciated the achievements of the project teams both from ESTEC and from industry, for having established a detailed design, built and fully tested a highly representative prototype in just over two years. However, the time criticality of the programme remains, the flight model has to be delivered by the end of this year, ready for its calibration and thereafter for integration into the ERS-2 satellite.

CNES Postpones SPOT 3 Launch

93WS0672A Paris *AFP SCIENCES* in French
12 Aug 93 pp 5, 6

[Article: "Postponement of Spot 3 Launch"]

[Text] Paris—The launch of France's SPOT 3 earth observation satellite, which the Ariane was scheduled to carry into orbit the night of 31 August-1 September, has been delayed due to a malfunction in its electrical circuits that was discovered during a test, CNES [National Center for Space Studies] reported on 6 August. "Arianespace will announce the new launch date as soon as possible," the French space agency added.

CNES indicated all electrical equipment was to be checked to make sure it functions correctly so that "work can be resumed with full confidence" in all systems. "Accordingly, the satellite will not be ready for launch on Ariane No. 59 the night of 31 August-1 September, as initially planned."

The SPOT system has been developed by CNES, in cooperation with Belgium and Sweden, with the participation of the National Geographic Institute (IGN) and numerous French, Belgian, and Swedish manufacturers, including prime contractor Matra Marconi Space, Aerospatiale, Alcatel Bell, Alcatel Espace, ETCA [Central Technical Weapons Depot], SAAB-Ericson, SEP [European Propellant Company], and SODERN. Spot Image, a subsidiary of CNES, is the company handling commercialization of the imagery produced by the system.

Italy: Telespazio Launches TEMISAT Environmental Satellite

MI2109092593 Milan *ITALIA OGGI* in Italian
1 Sep 93 p 11

[Text] The launch of TEMISAT (Telespazio Micro-Satellite), the first Italian microsatellite entirely designed and funded by Telespazio of the IRI-STET [Institute for the Reconstruction of Industry-Turin Telephone Finance Company] was completed successfully from the Plesetsk launch site in Russia using a Cyclon carrier. TEMISAT has a five-year operating life and is a professional microsatellite that is capable of providing highly reliable commercial data

collection and distribution services for environmental monitoring purposes. TEMISAT, which was constructed by the company Kayser following an international call for bids, is capable of providing a solution to the problem of obtaining environmental parameters, provided by various sensors located over vast areas that are difficult and sometimes impossible to reach, and thereby eliminates the need to construct complex and expensive ground infrastructures over wide expanses. With an independent monitoring network, TEMISAT will guarantee data reception from remote terminals, which are linked to groups of environmental sensors, and distribution to user collection centers. From these centers it will be possible to send remote commands or brief operating messages to the terminals. A total of 50 collection centers and over 1,000 user terminals are already under construction and a satellite control and mission planning center have been installed at the Telespazio space center in Fucino.

The principal applications of the system include monitoring the oceans, agriculture, meteorology, and the climate as well as monitoring hydrographic and snow basins, and controlling the pollution of the environment and large-scale structures (buildings, dams, and others).

The commercial service is scheduled to begin in early 1994. Initially it will be offered on a daily basis to private and public users on a national basis and to users from the Mediterranean and bordering European regions, and later on a worldwide scale. Telespazio Managing Director Raffaele Minicucci stated: "With the development of TEMISAT, Telespazio has confirmed its leading role in helping to resolve environmental problems and its commitment toward the development of microsatellite technology and identifying increasingly more advanced applications to better meet the most varied needs of users."

Ariane Rocket To Launch New SPOT-3 Satellite
BR2809122593 Paris LE QUOTIDIEN DE PARIS
in French 24 Sep p 24

[Article by Christian Sotty: "Ariane: Third Spot"]

[Text] For the third time, the European rocket Ariane will launch SPOT, the French earth observation satellite, tomorrow night. This third earth imager will be put into space just at the right moment, as its older brothers are developing some faults.

SPOT-1 was launched into space on 21 February 1986 on the 16th Ariane flight. SPOT-2 was put into orbit by the 35th Ariane rocket on 21 January 1990. SPOT-3 should, if all goes well, follow its older brothers Friday-Saturday night, as its takeoff on the 59th Ariane is scheduled for between 0327 and 0345 in the morning (French time).

This launch is particularly important to Spot-Image, the company responsible for marketing the images of the earth taken by the SPOT satellites, as the two devices circling the earth at an altitude of 822 km are beginning to show early signs of aging. Moreover, both of them are now working on their back-up circuits following on-board faults.

In spite of these minor upsets, it is worth noting the exceptional lifespan of SPOT-1 which, initially intended to function for two and a half years, is still active after more

than seven years of good and faithful service. As an indication, it supplied 60,000 images in 1992 and was used in the summer of 1993, at the request of the EC, to monitor the agricultural season in Europe!

Stella for Good Health!

The takeoff of the 59th Ariane rocket from the base at Kourou in Guiana will provide an opportunity for the European launch vehicle to notch a new record. Not in terms of on-board weight, since for this mission a basic Ariane-4 rocket, without strap-on boosters, has been reserved for putting the 2,118 kg it carries into orbit. The record is the number of devices carried under the nosecone of the rocket: There will be seven of them taking a trip into space!

Of course, SPOT-3 is getting the lion's share, as it weighs 1,907 kg. However it will be accompanied by the Stella satellite at its side, and, in a lower compartment, by five microsatellites.

With a weight of 48 kg, Stella is the twin satellite of Starlette, launched in 1975 and still operational. It is a very dense sphere of uranium alloy, on whose surface 60 laser reflectors have been placed. Stella is none other than a laser target which will allow scientists to establish the exact volume of the earth, which is not as round as we like to think. The principle for establishing the exact shape of our geoid is simple: A laser beam is aimed at the satellite; the beam is sent back to earth and the time taken for the laser beam to make its round trip is measured. This makes it possible to determine the exact distance to the nearest centimeter and to establish very precisely what our planet looks like. From the deformations recorded, it will be possible to carry out more detailed research into the phenomenon of the oceanic and terrestrial tides caused by the moon, or even to make a close examination of the movement of the tectonic plates.

Microsatellites

As for the five microsatellites (whose total weight is approximately 163 kg), their tasks are very diversified. HealthSat-1, built by the British for the American organization SatLife, will be used for humanitarian purposes to relay information to medical schools and universities, hospitals, and health documentation centers in Africa.

The Portuguese satellite Posat-1 has been created to encourage and train Portuguese manufacturers in space applications. Its mission is to receive and transmit images, determine its position with the help of the GPS (Global Positioning System), to record radiation measurements, to relay messages, and to experiment with signal compression techniques.

The Korean microsatellite Kitsat-B will join its twin, Kitsat A, which was also launched by Ariane on 10 August 1992. Its mission is more or less the same as Posat-1's: the recording and transmission of images, measuring radiation, implementation of signal compression techniques and data relay.

America's Eyesat-1 should be able to receive and transfer digital data to any point on earth. Its main mission will also be to locate and monitor certain industrial facilities.

As for Italy's Itamsat, it will be dedicated to carrying messages from radio hams to any point on earth—or in

space. The Russian cosmonauts on the Mir station sometimes entertain themselves by talking with radio hams from their orbiting dacha.

AUTOMOTIVE INDUSTRY

France: Experimental Car Sets Fuel Record

93WS0672C Paris AFP SCIENCES in French
12 Aug 93 p 35

[Article: "World Record in Fuel Economy Set by French Vehicle Prototype: 100 Kilometers on 0.82 Liter"]

[Text] Metz—A vehicle built by students at the National Engineering College at Metz (ENIM), in the Moselle, has just set a new world record in fuel economy, consuming only 0.82 liter per 100 km traveled in a 1,000-km test drive at an average speed of 50 kph, designers of the prototype disclosed on 11 August.

Previous records of this sort have been set at "Shell Marathon" fuel economy competitions, where prototypes have achieved consumption rates on the order of 2,000 km per liter. However, those rates are extrapolated from the amount of fuel burned over a 20-km stretch, whereas the Epure 3 was actually driven a distance of 1,000 km.

The prototype in its entirety was designed and built by ENIM engineering students working over a one and a half year period. Its body and frame are made of carbon fiber, and it is powered by a small 110-cubic centimeter Honda engine designed for farm machinery. Unlike other models of this kind, the Epure 3 has standard electrical equipment, which brings its total weight up to 100 kg, and it can travel at speeds up to 95 kph. The record was established last July on the Montlhéry track (Essonne), at the initiative of AUTO PLUS magazine.

United Kingdom: Ferodo Develops Clean Clutch Facing Production Process

BR2809143393 Toddlington NEW MATERIALS
INTERNATIONAL in English Sep 93 pp 4-5

[Unattributed article: "Water-Soluble Processing of Clutch Facings"]

[Text] Ferodo Caernarfon is claiming an environmental "first" with the development of a range of solvent-free clutch facings.

The company, which is the UK's only remaining clutch facings manufacturer, claims to have beaten French and German rivals in the race to produce facings for cars, trucks, and buses which do not use solvents in the impregnation process.

Ferodo's Managing Director Brian Lindsay said that the new products are the result of a four-year development programme carried out by Ferodo and supported by T&N Technology, T&N's central research and development facility at Cawston, Rugby.

He said: "The company has developed a processing method which enables the impregnation of raw material to be carried out without the use of solvents. Instead, our system makes use of water-soluble substances which are both environmentally friendly and provide improved working conditions for the workforce."

The uniqueness of the process lies in the fact that T&N has resolved the "chemical conundrum" of breaking down the various resins and rubbers that go to make up the clutch facing matrix or "dope." Traditional methods use solvents for this.

The latest move by T&N is the third leg in the long running process to make clutch units "greener." The first was the removal of asbestos; the second was the elimination of heavy metals (such as lead) that help to create judder-free performance. The removal of solvents from the manufacturing process was, perhaps, the next most obvious candidate. Within the industry there has been a trend to reduce product specific density from 2.2 for asbestos products to 1.9 for asbestos-free items. Now T&N has taken the figure lower to 1.6 with its latest design.

The clutch facings produced using the new process therefore have benefits for Ferodo's customers. The company claims that they have a higher burst speed to suit today's higher-performance engines, and feature lower density and improved anti-judder characteristics which enhance driver comfort by reducing clutch inertia and offering a smoother take-up.

BIOTECHNOLOGY

Netherlands: University Obtains 'World's Most Powerful' NMR Spectrometer

BR2809123193 Zoetermeer SCIENCE POLICY
in English Sep 93 p 23

[Unattributed article: "Nuclear Spin Resonance: Nuclear Magnetic Resonance Centre Comes to the Netherlands"]

[Text] The Netherlands is to acquire the world's most powerful nuclear magnetic resonance (NMR) spectrometer, with a frequency of 750 MHz. Researchers will use the instrument to measure the structure of carbohydrates, DNA fragments, and proteins. The spectrometer will be located in the new Nuclear Magnetic Resonance Centre on Utrecht University's Uithof campus. The Centre is expected to be operational by the end of the year, and will also open its doors to researchers from outside the Netherlands.

The European Community is shelling out ECU1 million (2.2 million guilders) for the NMR Centre. The Netherlands Ministry of Education and Science is handing over 7 million guilders. Moves to establish the Centre first came from Utrecht University's Bijvoet Centre, Nijmegen University's Nuclear Spin Resonance (NSR) Centre, and the Dutch Chemical Research Foundation (SON).

Driven by powerful magnets, NMR technology is used to analyse substances and unravel unknown compounds. The new NMR spectrometer can be used on larger, less concentrated molecules than instruments already in use. Its field strength is 17.6 tesla, or 300,000 times the strength of the earth's magnetic field. This field strength makes it possible to obtain information on larger molecules such as proteins, carbohydrates, and fragments of DNA. With the NMR spectrometer, researchers can examine these molecules under near-natural conditions.

DNA, carbohydrates, and proteins all play a major role in molecular recognition. Interactions between them usually cause a chain reaction, culminating in a physiological effect

such as the contraction of a muscle or the digestion of food. Knowledge of the structure of the molecules involved is not only important for our understanding of molecular recognition; it is indispensable for the scientific development of new medicines.

As well as analysing the structure of substances, the NMR spectrometer can analyse bodily fluids such as bile—a capability that opens up new horizons in diagnostics.

To manage the NMR Centre, its three prime movers have created the Bijvoet-NSR Institute. Researchers from all over Europe may submit research proposals to the Institute if they wish to use its equipment. An international committee, with representatives from the Institute and from outside the Netherlands, will monitor access to the NMR spectrometer. Research will be supervised by Prof. J.F.G. Vliegthart and Dr. R. Kaptein (from the Bijvoet Centre) and Prof. C.W. Hilbers (from the NSR Centre).

COMPUTERS

Germany: Supercomputer To Aid Parallel Processing

93WS0637A Frankfurt/Main FRANKFURTER
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT
in German 16 Jul 93 p 8

["Supercomputer for Small Research Budgets: Intel Introduces an Entry Computer for Universities"]

[Text] Frankfurt—The Intel electronics company wants to provide European research institutes and universities the opportunity of conducting practical experiments with scalable high-performance computer platforms. To this end, Intel GmbH, situated in Feldkirchen near Munich, has announced its "entry" supercomputer—Paragon XP-E. The university program included is singularly tailored to the requirements of university applications in the various countries.

Intel based its initiative on the fact that valuable pioneer work in scalable high performance computing (SHPC) has been carried out in Europe. The universities, which could be linked together as satellites in a network, would be able to develop parallel applications and algorithms locally and then execute and check them out on a large central Paragon XP/S computer. The company anticipates that 10 Paragon XP/S systems will have been installed in Europe by the end of this year. Since most European researchers do not have the money for a large system, Intel is now offering its economical Paragon XP/E. The nodal and linking structures, the operational system, the design and programming environment all correspond to the large XP/S system, but the individual elements in the XP/E are housed in inexpensive casings consisting of a backplane for one of two cards as well as power packs and fixed disks.

The XP/E is scalable from 4 to 28 computer nodes and can be upgraded to the XP/S system. In addition, all XP/S options are also available for the XP/E. Using these supercomputers, the universities could even develop parallel applications, which could be scaled to performance in the teraflop range. Computer capabilities in these orders of

magnitude are required for the extremely extensive computations in the fields of climate modelling, elementary particles physics, and the simulation of molecules.

DEFENSE R&D

First Ground Tests for Eurofighter Prototype

93WS0672B Paris AFP SCIENCES in French
12 Aug 93 p 10

[Article: "First Ground Tests for Prototype of Eurofighter 2000"]

[Text] Manching—The prototype of the "Eurofighter 2000" European fighter aircraft (EFA) has undergone its first ground tests at the Manching test center near Ingolstadt, the Deutsche Aerospace (DASA) aeronautics group announced on 5 August.

The tests, intended primarily to test the aircraft's flight controls and landing gear, were "very convincing," according to DASA. The prototype could make its first flight before the end of 1993.

Participating in the Eurofighter 2000 project are DASA, British Aerospace (United Kingdom), Alenia (Italy), and CASA [Spanish Aircraft Manufacturing Inc.] (Spain). It is a lighter, 30 percent less costly, version of the EFA approved last December by the defense ministers of the four countries building the warplane. Germany at the time said the initial design of the aircraft failed to meet the new strategic needs of the post-Cold War period.

ENERGY, ENVIRONMENT

Germany: Spectrometer Used for Automatic Waste Disposal

MI3009112693 Bonn WISSENSCHAFT WIRTSCHAFT
POLITIK in German 18 Aug 93 p 5

[Text] Whether plastics waste consists of PVC [polyvinyl chloride] or other common plastics can be determined in seconds by a surface discharge spectrometer developed in Duisburg.

It can also tell whether the samples contain metallic reinforcing or filler materials. The sample surface is vaporized with high-current surface discharges. This makes the components of the material display their characteristic atomic spectra. The control and evaluation electronics display the analytical findings shortly afterwards.

Sorting has so far been an expensive process and is mostly done manually as part of the "green dot" recycling campaign. The handy, portable and quick surface discharge spectrometer for sorting plastics was developed by Prof. Alfred Golloch of the Instrumental Analysis Department of Duisburg Polytechnic, and could be used in the dual system to undertake tasks at present performed by people in not very pleasant surroundings.

Every year, 2.5 million tonnes of household and industrial plastic waste are produced. New high-quality plastic products could be made from them again if the various sorts could be quickly and accurately separated.

Norway, Kuwait: Kuwait To Test Efficient Norwegian Sand Cleansing System

BR1409091893 Oslo AFTENPOSTEN in Norwegian
31 Aug 93 p 36

[Article by Trond Boe: "Kuwaiti Oil-Polluted Sand To Be Cleaned"]

[Text] Stavanger—Some time during the next two months, Norwegian inventor Olav Ellingsen from Florø hopes to have a test unit set up on-site in Kuwait. The aim will be to demonstrate to the Kuwaiti national authorities that his system represents the most effective way of cleaning the oil-polluted desert sand left behind by the Gulf War.

Ellingsen has gained widespread recognition, for the new technology has already been used to remove all kinds of pollutants from solids such as earth and sand. The breakthrough for the new invention came two years ago when he was awarded first prize at the ENS '91 environmental trade fair held in Stavanger, and he has since cooperated with Statoil to further develop his cleaning system. Statoil has now ordered one unit for its Mongstad refinery, and a second unit will shortly be sent to the Shetland Islands.

'Turbomixer'

Ellingsen's unit uses an enormous "turbomixer" which whips the oil-polluted sand around so hard that it generates heat. The oil then evaporates and is channelled through a condenser before it can sent back to the refinery, leaving the powdery sand nearly 100-percent free of oil and other pollutants, according to laboratory tests carried out by Ellingsen in England.

"The advantage of this process," claims Ellingsen, "is that the reclaimed oil can be reused. Also, the fully contained process does not release any emissions into the atmosphere." Ellingsen believes that his process consumes less energy and causes less environmentally damaging emissions than other cleaning methods which are based on burning off the pollutants at high temperatures.

The oil in Ellingsen's "turbomixer" evaporates due to the heat generated by friction when the sand is violently whipped around. The method works on a large number of different pollutants, from tanker oil residues to heavily polluted soil. For example, Ellingsen claims that cleaning up the harbor pollution at, say, the Haakonsvern in Bergen, would be a commercially viable proposition for his system.

World Market

"We last tested the unit on desert sand from Kuwait in January and the unit worked entirely according to plan. The challenge for us will be to demonstrate the unit to the authorities and refineries in Kuwait which are faced with a massive clean-up operation," Ellingsen told AFTENPOSTEN. A standard unit would only be capable of cleaning 10-15 tons of decontaminated material per hour, depending on the water content. The Kuwait Institute for Scientific Research has assessed the method and concluded that it is one of the most effective available for cleaning oil-polluted desert sand.

One of the refineries in Kuwait had accumulated 860,000 tons of oil-contaminated material since 1946, which it had no idea how it could clean. This is where Ellingsen's

turbomixer comes in, as one of the best—and also one of the cheapest—units on the market.

Thermtech AS is the company marketing the unit, and the technology is now to be launched on the market for refineries in Poland, France, Germany, and the Netherlands. Thermtech has spent 10 years and nearly 20 million Norwegian kroner on developing the turbomixer and sees considerable commercial potential for the product on the world market. This year two units have been sold, and next year Ellingsen reckons that between five and seven units will be exported from the Florø plant.

FACTORY AUTOMATION, ROBOTICS

Germany: "Smart Screwdriver" To Replace Dynamometric Key in Machining Company

93WS0677A Duesseldorf VDI NACHRICHTEN
in German 13 Aug 93 p 13

["'Multiscrewdriver' Makes Many Assembly Jobs Easier. Frequently Used Tightening Parameters Can be Stored Electronically"]

[Text] VDI-N, Nuremberg, 13 August 93, AS—For years the workers in the heavy labor workshop belonging to the MAN Engine Research Division in Nuremberg had to do screwing operations involving torques of between 10 Nm and 360 Nm by hand. To avoid using the torque wrench (dynamometric key), 24 power screwdrivers would have been required in a very small space. Then a five-instrument solution, based on a screwdriver with EDP intelligence, was found.

Whoever has had to tighten the 72 cylinder head screws of a 12-cylinder automotive diesel by means of a torque wrench (six very difficult ones per cylinder) knows what arduous work that can be. And that was not the end of it. For when MAN's Engine Research Division workshop in Nuremberg sets up an experimental engine on the test stand—an event that occurs more than once a week—then the cylinder head assembly is just one screwing operation among many others, where the torques range from 10 Nm to 360 Nm.

For years now, the director of the workshop, Werner Haeckler, would have liked to spare his workers this job, which could only be performed by raw physical strength. But whenever he discussed alternatives with the screw manufacturers, it came down to the fact that for the up to 42 recognized screwing operations (16 of which are torque/torsion angle-controlled), 24 screwdrivers were actually required. Aside from the fact that it was very difficult to handle so many tools in such a small space, it was also a very expensive operation. Not just one engine assembly stand, but four, had to be used.

In the Fall of 1991, Haeckler could report to the research directorate that a solution had been found to do the job with just five screwdrivers. The main tool was a torque screwdriver whose torque range extended from 100 Nm to 550 Nm. After several tests the director of the workshop determined that besides four standard screwdrivers for all the low torques, the remaining 20 screwing operations could be covered by the new torque screwdriver, which could be adjusted by its electronic control system to any desired torque from 100 Nm to 500 Nm and which can even perform torsion angle screwing.

Actually only four impulse screwdrivers hang over each engine stand today. They suffice for all "normal" screwing operations up to 100 Nm. All higher torque and especially the critical screwing operations are tightened with the aforementioned pneumatic allround screwdriver—electronically controlled and documented. This high torque screwdriver with its electronic control system, mounted on a moveable base, serves as a "jumper" and relieves the workers not just from their heavy muscle work but it has also introduced greater safety and greater accuracy in repeated operations. "We need reproducible conditions for our experimental tasks, even for screwing operations," Haeckler notes.

Besides customer and project-oriented tasks, the Engine Research Division in Nuremberg today concentrates primarily on the possibility of using alternative fuels—from plant oils to natural gas. In this research, the test series uses MAN batch-produced engines, which are then either rebuilt, converted, or otherwise made ready in the workshop to accommodate the various fuels. In the conversion process, the 4- to 12-cylinder, 100 kW to 800 kW bus and automobile engines are usually totally disassembled and then reassembled again to suit the test conditions. The procedure entails screw-intensive assembly work in which precision, not time, is the major concern, especially in the critical screwing operations on the connecting rod, cylinder heads, crankshaft bearing plate, vibration dampers, and flywheel.

If they are not screwed-in precisely according to design instructions, no comparisons can be made between engines, the measurement results of subsequent test runs would be irrelevant, and the time schedule for the research program is put in jeopardy.

When the workshop learned of the coupling-free pistol screwdriver, it could perform torque-, but not torsion-angle-controlled screwing. But Haeckler needed both capabilities and therefore proposed a series of experiments—not in the Nuremberg Engine Research Division, but at the screwdriver plant in Essen.

This particular kind of screwdriver is well suited for the broad-spectrum of torques required in Nuremberg. Its two-stage tandem engine operates well in torque ranges that had for so long in the past been reserved for impact screwdrivers alone; it can vary the air pressure in the torque at will. In order to implement the additional torque/torsion angle-controlled screwing capability required, the coupling-free screwdriver needed only to be fitted out with a sensor for the torsion angle. A torque sensor—integrated in the counter-torque support which is indispensable for such a high-caliber torque screwdriver—already was an integral part of the equipment standard just as the necessary control and guidance electronics is in parameter-controlled screwing. It monitors the correct tightening and signals (via light-emitting diodes) when the specified value has been exceeded or is undershot. In addition, it stores the screwing results.

What workshop director Haeckler still wants is more than the seven preprogrammable parameter records for the 20 possible screwing operations. But he manages anyway. For the seven most frequent screwing operations, the parameters for the tightening torque and the torsion angle control can be called up on the keyboard, although the others must be input from case to case by the worker.

The screwdriver can still only turn in one direction. For loosening operations, the Nuremberg workmen therefore use a different screwdriver. In this case it was decided that the torque sensor not be integrated, but rather housed in a ring pack to the front of the screwdriver. Then, after a test run, the loosening torque values can be used to determine how particular screw joints have behaved in the test. The torque sensor need only be transferred from the tightening to the loosening screwdriver. This can be done quickly. Then the complete loosening torque can be determined and documents by focus electronics also used during the loosening process.

Practical experiments have also shown that if the screwdriver is to deliver its highest possible torque, it requires a hydraulic pressure of 6 bar overpressure. If the workshop power net supplied only 5 bar, the screwdriver loses one-fourth of its power performance.

Photo Captions

1. p. 13 (top center): The flexible high-torque screwdriver in everyday use in the MAN workshop in Nuremberg. This tool can handle all critical screwing operations between 100 Nm and 500 Nm torque. For torques under 100 Nm, four impulse screwdrivers are used.

LASERS, SENSORS, OPTICS

Germany: Diode Laser To Improve Beam Focusing Problem

93WS0645A Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 29 Jul 93 p 8

["Diode Laser Masters Focusing Problem: Fisba Optics AG Reports Performance at the Upper Limit of Conventional Systems"]

[Text] JB. Frankfurt—In recent years high-performance diode lasers, particularly in the 5-20-watt range, have appeared on the market. They are highly efficient and permit smaller lasers to be produced than hitherto. Unfortunately, until now, they have left much to be desired by way of beam quality. Beam-focusing on a relatively small surface consistently presented problems.

A new laser system, equipped with focusing optics, has reportedly solved this problem. It was developed by Fisba Optics AG (Address: Rorschacher Str. 268, CH-9016 St. Gallen, Switzerland) and consists of a diode laser chip with a special optical focusing system. As the company reports, it is not enough simply to improve the laser beams by back-end optics, since that would greatly attenuate laser power. To avoid power attenuation, the Swiss researchers decided to reduce the diode laser area being emitted.

The result is a laser chip producing emitted laser streaks that are only 0.4 millimeter wide, each streak having a power of 2 watts. Each of the laser streaks can be easily produced and focused. To increase the overall power, 50 separate streaks having a total power of 100 watts are focused on a focal point 0.5 millimeter in diameter by means of cylinder lenses, image-rotating elements, and spherical lenses.

The prototype of the new laser system generates a power of 100 watts, of which 50 watts are available to the user after

focusing via a fiber coupling. The modular-designed instrument is quite compact, weighing less than 50 kilograms, 5 kilograms of which is taken by the laser head. The service life of the laser is given at from 2,000 to 10,000 operational hours.

The effective efficiency of the Fisba laser exceeds 10 percent, indicating that the system is at the upper efficiency limit of conventional systems. Moreover, the material and energy requirements for its operation are significantly less than those of conventional systems of comparable performance. The system could, for example, be used in medicine to coagulate tissue and in industry for material processing, marking, and soldering.

Silicon Optoelectronic Research in Berlin Described

93WS0660B Duesseldorf *HANDELSBLATT* in German 5 Aug 93 p 17

[Article by Thomas Jonas under the rubric "Research and Technology: Optoelectronics": "Silicon Chips for Optical Fiber Technology Too. Work at Technical University of Berlin. Tiny Grains of Sand to Show the Right Way Faster to Infrared Light"; first paragraph is an introduction]

[Text] Wednesday, 4 Aug 93 (*HANDELSBLATT*)—Microelectronics is an unparalleled success story, for within just a few decades it has managed to develop ever more powerful components that in addition have become ever smaller, more economical and even less expensive too. Optoelectronics, i.e., the transmission of information signals by means of light instead of electric current, is indeed still far from such goals, but a Berlin researcher now wants to change this, as he is introducing silicon as a new material in optical fiber technology.

Professor Klaus Petermann of the Institute for High-Frequency Engineering of the Technical University of Berlin this year was awarded the Gottfried Wilhelm Leibniz Prize of the German Society for the Advancement of Scientific Research for his work on "integrated optics." Actually, silicon is impervious to light—but only in the wavelength range of light visible to the human eye. In the infrared region, however, it is the clearest glass, and it is precisely these wavelengths that are most used in optical fiber technology. Though engineers have by now been able to produce such fibers without any difficulty, yet thus far the hitch has been the manufacture of very small components that have to be connected to optical fibers, like, for instance, interconnection devices or converters as the starting and end points of the signal circuit.

Silicon Oxide Insulating Layer

Petermann has already been able to prove that silicon is really suitable as a base material for such components. He has succeeded in giving infrared light a defined route for its path through a silicon wafer to which optical fibers are attached on both sides. Meanwhile, such "light roads" can be "asphalted" quite conveniently, for they are paved with an insulating layer of silicon oxide. The coating of thin fibers made of germanium has also proven successful.

The goal is to keep as low as possible the attenuation or scattering of the incoming light beam. Still, the Berlin team has already managed to lose less than 10 percent of the light

fed in, in a wafer length of one centimeter. In addition, the researchers have succeeded in proving that "circuit switches" for rerouting the light to specific modules as desired can be installed in the just finger-nail-sized silicon wafer. Because there are no moving parts in optoelectronics—just as in microelectronics, electrons in the material assume the switching function, as they react to control pulses from outside. Nearly endless series of measurements are necessary for the optimal design of such "switches." Computer simulation can take on part of the tedious and difficult work here.

"Very large-scale integration" are the magic words Klaus Petermann illustrates as follows: "We want to achieve a microchip design density with which approximately one million switching elements can be accommodated at once on the surface of a thumbnail." The mass production of standardized and consequently less expensive components would also be possible then with miniaturization. Finally, complete functional modules of switching elements with connected optical fibers could be manufactured directly at the optical fiber plant. This would master one of the quite major problems of optoelectronics all over the world: That is, when individual components are interconnected, the terminals have to be interconnected with a directional precision of a thousandth of a millimeter.

However, Petermann's team is still far away from usable products, though silicon in its opinion is not without a chance versus the materials customarily used at present: After all, it is as available, in the truest sense of this expression, as sand on the seashore, and in addition there are a number of extremely successful engineering principles from microelectronics.

Improvement of Conversion Efficiency

Besides integrated optics, the Berlin scientists are also working on improvements in the components themselves. Because the conversion of light into electric current has to take place at the end of the transmission route. Such a change in the information carrier is necessary also at the entrance to the optical fiber. The researchers are trying to improve the efficiency as well as the operating speed in converters. Among other things, it is a question of keeping the so-called dark current as low as possible—no current is to flow without light incidence either. A further aspect of the work is devoted to the transmission limitations of optical fibers.

The research goes beyond sheer communications engineering to sensors. These measuring cells can detect the smallest electric or magnetic fields that occur in the environment of household appliances for example. It is important in this connection that the measured signals are led away not as electric current but as light, so that additional fields do not originate that would then distort the measurement results. These sensors promise uses in medicine too, in hyperthermia, for instance, when tissue suspected of cancer is warmed strongly by means of high frequencies: The measuring cells could determine which field strengths actually arrive in the patient's body.

MICROELECTRONICS

French-American Development of Molecular Switching Operator

93WS0645B Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 30 Jul 93 p 8

["Molecule Functions as a Photo-Electric Switch: A Different Molecular Becomes Logic UND Operator"]

[Text] nrb. Frankfurt—French and American researchers have developed a molecular switching operator that can be activated by an electrical signal. The operator is in effect a ruthenium complex bonded by quinone. In its oxidized form, the quinone does not radiate light. However, when the quinone is reduced by an electrical voltage of about 0.4 volts, it displays a clear luminescence.

Members of a research team headed by Nobel Prize Winner Jean-Marie Lehn report in the Journal of the Chemical Society, Chemical Communications (19932, p. 1034), that since this process can be repeated as often as desired, the particle becomes a kind of photo-electric switch. Both the oxidized as well as the reduced form is infinitely stable.

The development of molecules that can "decide" is another step forward. Recently, chemists at Queens University in Belfast succeeded in synthesizing a molecule that can function as a logic UND operator. Prasanna de Silva and associates report in Nature (1993, Vol. 364, p. 42) that the molecule only reacts to laser radiation when hydrogen and sodium ions are present simultaneously. The presence of only one ion species does not result in a reaction.

The molecule consists of three components: an anthracene structural element, a tertiary amine, and a crown ether. The anthracene is capable of absorbing ultraviolet light, while the other two components are the sensors. They are specifically for binding hydrogen and sodium ions.

When the particle is radiated with ultraviolet laser light, it emits only a weak blue light. The light radiation increases somewhat when an ion species is bonded in. However, it is only when ions are bonded on both sensors that the molecule radiates six times more strongly. The behavior corresponds to that of a logic UND operator. Even though its application in molecular computers is in the distant future, the researchers are of the opinion that the molecule can already be used for the real-time monitoring of ion concentrations.

SGS-Thomson Opens Innovative Chip Factory

93WS0668C Paris L'USINE NOUVELLE in French 22 Jul 93 p 44

[Article by Jean-Pierre Jolivet: "SGS-Thomson Leaps Ahead in Chip Production"; first paragraph is L'USINE NOUVELLE introduction]

[Text] The geometry of integrated circuit designs will drop to 0.2 micron after the year 2000. What's more, manufacturers will have to produce 20,000 silicon wafers a month in 1995-96 to stay competitive.

SGS-Thomson will begin delivering chips produced at its new Crolles factory near Grenoble (Isere) at the end of the year. The deadline is a gamble, falling as it does fewer than

six months after the June qualification of the company's first circuits fabricated on 200-millimeter silicon wafers. The advance makes the Franco-Italian semiconductor manufacturer the second European firm to master this production technology. The IBM-Siemens team, whose first 16-Mbit Dram memories are rolling off IBM's lines in Corbeil-Essonnes, is the first.

Besides the technological leap (circuit design geometry is dropping from 0.7 to 0.5 micron), the Crolles factory represents a major stride in the design and production methodology of chips. That is only to be expected, since SGS-Thomson designed the plant to keep up with the changes in semiconductor manufacturing beyond the year 2000. By then, technologies will drop below 0.2 micron, and chips will hold over 10 million transistors. The company invested a total of 3 billion French francs (Fr) in the plant, which will enable it to make integrated circuits (digital, then analog and hybrid) for telecommunications, computing, video, future microprocessors, and custom circuits. The production rate of 2,000 wafers a month planned for the end of the year will triple in late 1994. And when the factory is running at full capacity—sometime between 1995-96—it will produce 20,000 wafers a month.

The choice of a flexible, open-ended plant required new solutions. SGS-Thomson is working with the National Technical Training Center (CNET), which underwrote half the cost of the factory, and Philips on research and development. It will use the same equipment to perform R&D, qualify the technological options on a pilot line, and mass manufacture the chips. This approach will enable the manufacturer to start production sooner, enhance processes continually, and get a better return on investments. The chipmaker has opted for the Japanese concept of factory-wide cleanliness: The plant boasts a class-100, 3,400-square-meter process platform that holds 52 basic class-1 modules linked by a class-10 central corridor. A laminar flow pressurized at 40 pascals above normal (to keep particles out) maintains the class-1 clean room. (Class 1 signifies fewer than 3.5 particles with diameters of less than 0.12 micron per cubic meter of air.) The flow travels vertically through each cubicle, and replaces the air 500 times an hour, eliminating the need for doors, whose friction can cause contamination. Ultimately, robots will transport the wafer batches between the different areas involved in the chip-manufacturing process.

Now SGS-Thomson must achieve the critical output threshold. Producing large runs of Dram memories is important in mastering the processes involved in the fabrication of other types of integrated circuits. Such mastery determines output. SGS-Thomson decided to offset the handicap of not being active in the Dram niche by producing circuits that could be customized to meet client needs and that would consist of many identical basic cells. "These 'seas' of gates will allow us to control output, as is done with Dram memories," remarks Gerard Matheron, SGS-Thomson's director of research and development programs.

The Crolles factory is opening at a key moment in the Franco-Italian chipmaker's history. The stubborn persistence of its managers and the support of its French shareholders—who have just invested nearly Fr5 billion to recapitalize the group and fund research—has succeeded in

pulling SGS-Thomson's head above water. The company posted profits of Fr130 million for the first quarter of 1993, and is nibbling away at the market share of competitors who are having trouble delivering, for lack of investment in their factories. SGS-Thomson officials are watching the development of the Crolles factory very carefully.

Netherlands: ASM Lithography Builds Upgradable Wafer Stepper

BR1709141793 Rijswijk POLYTECHNISCH WEEKBLAD
in Dutch 6 Aug 93 p 1

[Unattributed article: "Upgradable Wafer Stepper Developed"]

[Text] The company ASM Lithography [ASML] in Veldhoven has broken an expensive habit with the introduction of a wafer stepper which can be upgraded with different generations of integrated circuits. This means that it will no longer be necessary to use a different machine at each stage. "INTEL's Pentium or DEC's Alfa chip are first built with greater resolution, after which a transfer is made to smaller structures," says Martin van de Brink of ASML. "This transfer can now take place in the same plant." The PAS 5500/100 I-line stepper can be used for critical line widths as small as 0.35 microns, including the new 64-megabit DRAM [dynamic random access memory], for which production facilities are now being set up. Van den Brink does not exclude the stepper being usable for non-critical layers in 0.25-micron technologies by the end of the century.

NUCLEAR R&D

Germany: DESY To Restructure Particle Accelerator Research Program

93WS0677C Duesseldorf VDI NACHRICHTEN
in German 13 Aug 93 p 8

[Article by Petra Harms: "In Future Doris III Will Serve Only as Roentgen Source"]

[Text] VDI-N, Hamburg, 13 August 93—DESY (German Electron Synchrotron) in Hamburg has decided to change the experimental program on its Doris III particle accelerator. Beginning immediately, the electron storage ring will be used exclusively as an intensive source for the so-called synchrotron radiation, by means of which investigations in the various natural sciences are made—investigations that cannot be conducted with conventional radiation sources. The electrons circling within the ring accelerator emit an intensive, laser-like, bundled electromagnetic radiation, called synchrotron radiation. It embraces a broad spectrum of wavelengths, from which Doris III uses mostly the Roentgen range.

Since 1974, this storage ring has been operated in two ways, namely, as a source of electron-positron collisions for particle physics and as a Roentgen source for other experiments. Now the operating conditions of Doris III will be optimized, full time, for the use of synchrotron radiation. In this way, DESY's second "research leg" has been decisively strengthened.

The measurement program for particle physics, which has been successfully conducted on the Doris electron-positron storage ring for over 20 years will be discontinued because a

similar facility at Cornell in the United States can, for technical reasons, deliver even more data for electron-positron particle physics. In any case, analysis of the measurement data obtained from Doris in recent years with the Argus detector will continue in the coming years since many interesting results are still expected by the scientific community. Argus has been used with the Doris storage ring for more than 10 years. During this period, the 90 Argus physicists have recorded and analyzed—under various aspects—about 4 million "events" of electron-positron destruction in particles belonging to the "hadron" family, and they have published more than 120 scientific papers. However, because the potential of the data already on hand has not yet been exhausted, the Argus group will continue its evaluations in the coming years.

The beneficiaries of this decision are the some 1,000 scientists from 25 countries, who come to DESY in Hamburg with their instruments and specimens to be investigated. Today, they can continue to conduct and develop their experiments in solid state physics, surface and molecular physics, mineralogy, crystallography, molecular biology, and medicine at 41 work spaces in Hasylab (Hamburg Synchrotron Radiation Laboratory), a DESY facility. In the past 20 years synchrotron radiation has developed into one of the increasingly important tools in such research. For that reason, Doris, a 288-m ring had been expanded into a better Roentgen source (Doris III) two years ago. Space was created for additional magnet arrangements (wigglers and undulators), and additional work space provided. In wigglers and undulators, the electrons racing around in Doris in an alternating magnetic field are caused to make additional "snake movements." In doing so, they emit the electromagnetic radiation in sharply bundled cones. Furthermore, the radiation is up to a thousand times more intensive than would be in the case of a trajectory without these magnets.

Electrons and their antiparticles (positrons) have been accelerated in Doris (originally a double ring storage) and impacting each other under high energy since 1974. The processes that occurred in the collisions have been measured and analyzed by the physicists with highly sensitive instruments. In all, eight different particle detectors were in use in Doris. The tiniest particles, smaller than a hydrogen nucleus would appear, which would then often disintegrate again into fractions of a billionth of a second. The study of such processes produces important knowledge concerning the nature of materials. During the last 10 years, these studies had been carried out very successfully on Doris by a 90-man international physicist team using the Argus detector. In addition, Doris was always available for synchrotron radiation experiments—at times concomitantly, at times exclusively. This past successful dual use of Doris has now been concluded by the termination of the Argus measurement program. In future, DESY's particle physics experiments will be concentrated entirely on the large Hera (hadron-electron ring facility) storage facility, on which research studies had begun a year ago.

Germany: Volkswagen Foundation Funds Nuclear R&D

MI3009114593 Bonn WISSENSCHAFT
WIRTSCHAFT POLITIK in German 1 Sep 93 p 4

[Text] The Volkswagen Foundation has introduced a new area of sponsorship: "Intra- and Intermolecular Electron Transfer."

It is aimed at the study of those chemical processes for which an electron transfer is essential. It concerns mainly chemistry, but also touches on other disciplines, particularly physics and biology.

Omnipresent but Not Always Apparent

Electron transfer is the simplest and at the same time virtually omnipresent elementary reaction in chemistry. It determines for example the chemical transformation of metals, it initiates bond formation in natural and synthetic hydrocarbons, and it is also the central step in vegetable biosynthesis. It also plays a role in many fields of technology, such as fuel cells or switching processes.

Ever Quicker Processes Observed

The speeds of electron transfers depend on the nature of the reaction partners, environmental influences, and the effort required to modify the molecular structures involved. Some processes run extremely quickly. But the development of methods of measurement in the last few years enables faster and faster processes to be observed and thus also reactions to be examined that have not previously been considered from the angle of possible electron transfer processes.

Interdisciplinarity

The sponsorship will bring together in particular chemical, biological, and physical research. Support will be given to projects (including exchanges of personnel between teams) and conferences.

Austrian Government Funds Nuclear Spallation Project

MI2109151893 Munich SUEDEDEUTSCHE ZEITUNG in German 2 Sep 93 pp 33

[Text] The government in Vienna has recently decided to support the planned spallation source AUSTRON as the major Austrian large-scale research project. A preliminary study is scheduled for completion by the end of October, and parallel attempts will be made to attract funding from other European countries. According to current plans, AUSTRON could be built in the year 2002.

A spallation source represents an alternative to conventional neutron sources, in other words, research reactors. Neutrons, the uncharged components of atomic nuclei, are primarily used in research into the structure of materials. The difference between a reactor and a spallation source is that the former supplies a continuous neutron flux, whereas the latter works on a pulsed basis. It is an accelerator in which heavy elements are bombarded with protons, thus generating neutrons and other fission products, the advantage being that it does not involve handling enriched uranium, although it does produce radioactive waste.

It had previously been assumed that a spallation source was considerably more expensive than a reactor, but the cost of building AUSTRON is estimated at the equivalent of 430 German marks [DM]. This would make the facility cheaper than the research reactor planned for Garching near Munich, which will cost at least DM500 million. AUSTRON is to be pulsed at the high rate of 10 hertz, which will eliminate several of the drawbacks due to the flux being

lower than that generated by reactors. It is planned to create a center for research into new forms of radiation therapy around the spallation source.

Italy: Synchrotron Light Machine Nears Completion

MI1009111793 Milan ITALIA OGGI in Italian 2 Sep 93 p 13

[Text] By the end of the year the Elettra synchrotron light machine will begin operating in Trieste. Elettra is being constructed by the company Synchrotron Trieste Inc., whose president is Nobel prizewinner Carlo Rubbia and which includes among its members ENI [National Hydrocarbons Corporation] Ricerche and SPI (Industrial Promotion and Development) of the IRI [Institute for the Reconstruction of Industry] group.

The event will be commemorated with a ceremony scheduled for late November, early December. Meanwhile the last section of the linear accelerator is being completed and the first light line, to be used for microscopy, is being assembled.

The construction of the machine began in 1987 and all deadlines have been met despite initial difficulties encountered with the acquisition of the site. The machine is a highly strategic instrument for scientific, industrial, and economic development. The first in Europe, it was constructed using innovative technologies. It is a super microscope that is capable of exploring the atomic composition of the samples to be examined.

It will be used in an extremely wide range of applications in biology, chemistry, and solid state physics. The heart of the machine is the LINAC [linear accelerator] which brings electron beams generated by a thermoionic source to a 1.5 billion electronvolt energy.

The electron beams are injected from the LINAC into a 250-meter long accumulator ring with an 80-meter diameter and inside which curving magnets and other devices (wigglers and undulators) force them to lose their energy under the form of synchrotron light. This light is directed into special channels that terminate with experimental laboratories.

The ring has been constructed with an accuracy in excess of a fraction of a millimeter in a vacuum of around one millionth of an atmosphere. The machine will have a total of 22 light lines that will be used for experiments.

Some parts of the machine were supplied by Italian industries and the linear accelerator by a French company that is highly specialized in the sector, CGR MEV of Buc. The overall cost of Elettra is approximately 300 billion lire.

TELECOMMUNICATIONS

Germany: Siemens-Developed Mobile Communications Network in Operation

93WS0677E Duesseldorf VDI NACHRICHTEN in German 13 Aug 93 p 9

[Article: "Luxembourg Puts Siemens Mobile Communications Network in Operation"]

[Text] The Grand Duchy of Luxembourg has now put into operation the digital mobile communications network, which Siemens AG, Berlin and Munich, after 18 months

planning and construction, had turned over in ready-to-go condition. In late 1991, Siemens, as the main contractor chosen by Luxembourg's Post and Telecommunications Office, received the contract for the planning, installation, and inauguration of a network based on the European mobile communications standard GSM (Global System for Mobile Communications). The total value of the contract came to about 9 million German marks [DM] and included the delivery of message switching technology as well as 24 radio stations with an operations and maintenance center.

The Grand Duchy of Luxembourg has now become the first of the Benelux countries to operate a mobile communications network based on the GSM Standard. With about 10 digital mobile telephones per thousand citizens, Luxembourg can boast the greatest GSM-mobile communications density in the world. To date, 14 governmental and private network operators have awarded mobile radio contracts, using this technology, to Siemens.

United Kingdom: SuperJANET Academic Network Operational

BR1509141693 Maidenhead TELEFACTS in English
Aug 93 pp 22-23

[Article by Jane Watters, Peter Ellis, Diana Cripps, and Rachel Colyer: "Networks '93 Birmingham, UK, 29 June - 1 July 1993"]

[Excerpts] Networks '93 Conference and Exhibition was organized by Blenheim Online at Birmingham's National Exhibition Centre in the UK. The conference comprised plenary sessions as well as three parallel tracks on Internetworking, Managing Networks, and Networked Services Management. This report discusses just some of the presentations in order to give a flavor of the event. [passage omitted]

UK SuperJANET Network Pilot Begins Operation

One of the most exciting presentations at the conference was by Dr. Robert Cooper, UK director of Networking, Joint Network Team (JANET).

The existing UK academic network, JANET, provides packet-switched and IP connectivity for some 200 academic institutions at up to 2 Mb/s and links to the international

academic Global Data Network. In 1989, foreseeing a need to support advanced applications for the academic community such as imaging, the UK Government invested some £20 million in the development of JANET, and a major performance upgrade was planned employing broadband switching technology and high-speed fiber links.

Construction of the new network began in November, 1992, and the first pilot sites were connected in May 1993. The pilot phase involves the connection of six sites by 140 Mb/s Plesiochronous Data Hierarchy (PDH) fiber links which will support a 34-Mb/s data network and a pilot 34-Mb/s ATM [Asynchronous Transfer Mode] network using separate sub-channels of the overall bandwidth. The first operational services are 34 Mb/s IP links with the experimental ATM facilities to be introduced during 1993. BT has provided the fiber links as part of a contract worth £18 million and will use SuperJANET as a testbed for its new generation of broadband services. From late 1993, BT will upgrade the on-site access facilities to 155-Mb/s Synchronous Data Hierarchy (SDH), and the trunk network will be upgraded to 622 Mb/s. During 1994, Switched Multimegabit Data Services (SMDS) will also be provided, initially at 10 Mb/s. Cisco and Chernikeef have provided routers. Netcomm has supplied switches; GEC Plessey telecommunications (GPT), a video switching unit; and Silicon Graphics, workstations.

The first academic institutions involved are the universities of Cambridge, Edinburgh, and Manchester, Imperial College London, the Rutherford Appleton laboratory, and University College London (UCL). In addition, the University of London Computer Centre is connected to UCL, and the Hammersmith Hospital is linked to Imperial College by 34-Mb/s fiber links. Up to 10 further sites will be added during 1993, with pilot SMDS links to 29 sites to be added from November 1993.

Initial applications include the transmission of brain scans and other medical images which have already allowed the remote observation of surgical procedures, the exchange of satellite images, access to supercomputing facilities, remote pathological consultation, the sharing of large documentary sources, and distance learning. Dr. Cooper commented that one of the most exciting aspects of the project was the ready existence of applications amongst the academic community which have the capacity to exploit broadband connectivity. [passage omitted]

AEROSPACE

Brazil: SCD-1 Successfully Completes Six Months in Orbit

93SM0409F Sao Paulo GAZETA MERCANTIL
in Portuguese 11 Aug 93 p 11

[Article by Sao Jose dos Campos correspondent Virginia Silveira]

[Text] The Brazilian data collection satellite known as SCD-1 and launched on 9 February of this year from the Kennedy Space Center in Florida, U.S., completed six months of operation yesterday, orbiting at approximately 760 km above the earth. During this period, according to the National Institute of Space Research (INPE), which is responsible for developing it, there has been no sign of degradation of the systems that comprise the satellite, which means its useful life expectancy may be as long as two years.

The only change observed by researchers at INPE's Satellite Tracking and Control Center was in relation to the number of rotations by the satellite, which dropped from 120 rpm to 89 rpm. However, according to Pawel Rozenfeld, chief of the center, this reduction in the number of rotations had already been expected and does not pose a threat to its life span in space. As of 1146 yesterday, the satellite had circled the globe 2,612 times.

The satellite's successful performance in orbit, according to INPE Director General Marcio Nogueira Barbosa, has led to approval of a plan to use the SCD-1 via permanent installation of a data collection network within Brazil. Plans call for installation of a network of Data Collection Platforms (PCD's) composed of 250 channels for real-time transmission of environmental data. So far, according to INPE, about 27 PCD's have been installed in Brazil. Eleven of them are being used to measure carbon dioxide and ozone emissions; four are located in the ocean near the coast to measure the tides; and three are being used for meteorological measurements of humidity, air pressure, and temperature. INPE also plans to take advantage of platforms already being operated with foreign satellites by hydroelectric plants and by the Ceara Foundation for Hydrology and Meteorology (Funceme).

According to Director Marcio Barbosa, the Ministry of Science and Technology has reserved 200 satellite data collection platforms for use in operational projects and 50 for scientific research. Two major initiatives are being pursued in the operational areas: one of them in the context of the Northeast region calls for formation of units integrated with the Weather Forecasting and Climatological Studies Center (CPTEC) to monitor the drought in the region.

"Right now, eight units have been formed and 50 specialists have been trained," he noted. Their main job, according to Barbosa, will be to manage the water resources of the country's Northeast. Starting next year, INPE expects to install at least 80 data collection platforms in the region for this purpose.

Brazil: INPE Develops Engines Using Liquid Propellants

93SM0422Z Sao Paulo GAZETA MERCANTIL
in Portuguese 28 Aug 93 p 12

[Article by Virginia Silveira: "INPE Intends To Develop Engines Using Liquid Propellants"]

[Text] Sao Jose dos Campos—The propulsion group in the Department of Space Engineering and Control at the National Institute of Space Research (INPE) has begun carrying out a project aimed at mastering the technology for producing bipropellant liquid fuel propulsion units.

According to project coordinator Jose Nivaldo Hinckel, producing such an engine will give the INPE expertise in the development of apogee motors, which are a possible replacement for the final stage of the Brazilian Satellite Launch Vehicle (VLS).

Engines based on liquid propellants perform better than solid fuel propulsion units when it comes to placing a useful payload in orbit. The INPE project calls for producing bipropellant liquid fuel propulsion units with a thrust of 1 metric ton, or 10,000 newtons. Kerosene and liquid oxygen will be the propellants used.

According to Hinckel, research is to be financed with funds from the National Council for Scientific and Technological Research (CNPQ). Producing the prototype engine will cost at least \$500,000.

The phases of designing, fabricating, and testing the engine should be completed within 18 months, according to estimates by the INPE's propulsion group. The technology for liquid fuel engines is already widely used in rockets operated by the developed countries. In Brazil, according to Hinckel, the use of that type of engine is essential for developing a launch vehicle capable of placing a payload of several metric tons into orbit.

The Brazilian VLS rocket, which is being developed by the Aerospace Technical Center (CTA), was designed with solid fuel engines. On average, that type of engine requires from five to seven metric tons of fuel, whereas liquid fuel engines use a minimum of one metric ton. Solid fuel engines burn from 40 to 50 kg of propellant per second, while liquid fuel engines use only four kg per second.

Technological Lag

Brazil lags far behind in the development of liquid fuel technology. The U.S. rocket Saturn V, which took man on the moon in 1968, already had engines with that feature. Hinckel comments: "To develop it, they had to produce 50 different test models."

The INPE propulsion group has been developing liquid fuel engines since 1988. The program began with the development of hydrazine catalytic engines with a thrust of two newtons for use in the attitude and orbital control system for the remote sensing satellites (SSR's) operated by the All-Brazilian Space Mission (MECB).

According to Hinckel, the satellites in the SSR series will be equipped with 12 propulsion units each for three-axis control, with six of those engines being redundant. The propulsion units, controlled either by the satellite's on-board

navigation system or by commands sent from earth stations, provide the satellite with impulses that maintain and correct its orbit and attitude.

The project has already spent \$500,000. The INPE has already produced and tested three models of those propulsion units and is currently preparing to test the qualification model. The INPE's liquid propellant propulsion units also required the development of an engine with a thrust of 115 newtons for use in controlling the roll of the VLS (that is, preventing the rocket from moving around its main axis).

The prototype engine has been tested for an accumulated total of 15 minutes: "That is longer than is required for the engine's life cycle during the mission, when the total operating time is only a few minutes," he explained.

CORPORATE STRATEGIES

Brazil: Avibras Diversifies To Increase Profits

93SM0409D Sao Paulo GAZETA MERCANTIL
in Portuguese 13 Aug 93 p 8

[Article by Rio correspondent Fernando Paulino Neto]

[Text] In a market that has cooled down, both because of a decline in foreign demand (end of the Iran-Iraq conflict and the increase in competition caused by the United States's more aggressive approach to the sale of armaments that used to be almost completely absorbed internally), and the decline in internal demand (very few orders from the Brazilian Armed Forces because of budget cuts), Avibras [Avibras Aerospace Industry, Inc.] has decided to diversify in order to emerge from the crisis that sent it into Chapter 11 in January 1990. "We have already paid off our debts and are ready to get out of Chapter 11, which I expect to

happen by the end of the year," said company Vice President Rubens Domingos Pontes.

Before it went into Chapter 11, war materiel accounted for almost all of Avibras's sales. Now, according to Pontes, military sales are 65 to 70 percent of total volume. The executive said that the crisis in the defense industry is not unique to Brazil. "The United States had—worldwide—120,000 supplier companies for its Armed Forces, but now it has only 30,000," he said. Avibras is one of those firms.

To try to reverse its Chapter 11 status, having fully paid off its \$140 million in debts, Avibras entered a wide variety of fields. Now it builds 86 percent of the trolley buses used in Sao Paulo, and recently it sold 20 units to Argentina. It signed a contract with the Inmarsat group [International Maritime Satellite Organization], which does satellite transmissions, to handle distribution to Brazil and South America.

Auto Painting

Taking advantage of its rocket-painting technology, Avibras was subcontracted by General Motors to paint its Chevette and Opala models that are no longer produced, but for which the company has an obligation to do maintenance for 10 years.

Furthermore, with investments of \$7 million, Avibras is building a fiber optics factory, using technology transferred from Telebras [Brazilian Telecommunications Inc.]. The plant should be in operation within six or eight months. "Today we offer more than 200 products and services," he said. When asked about the military area, Pontes was more reticent. "We are in contact with several customers in the Middle East," he said, claiming that in that field, confidentiality is not just vital, but contractually required.

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